

REMARKS

The application has been amended to place the application in condition for allowance at the time of the next Official Action.

As to the specification objections noted on page 5 of the Official Action, applicants have the following comments. The disclosure of the actor incorporated into a tubular spring on page 3, line 7 and page 6, lines 26-28 is consistent with the drawing figures. As seen in Figure 1, the tubular spring 2 surrounds the piezoelectric actor body 1 and is connected thereto by the connection of the actor body to the header plate and the footer plate. Thus, the actor body including the header plate 4 and footer plate 3 are united with (incorporated into) the spring.

In order to further prosecution, the term "incorporated into" is changed in the claims to "within". Such amendment to the claims is believed consistent with the drawing figures and describes the relationship between the tubular spring and the actor body.

As to the perceived inconsistency between page 7, lines 13-19 and Figures 1 and 2, Figures 1 and 2 are amended to show the non-dotted rectangular section is filled with heat coupling fluid.

As to the objection to page 7, lines 6 and 7, the feed line 12 from Figure 1 is removed so as to clarify that the feed

line 13 feeds the valve chamber 11 as seen in Figure 1 and to clarify that the feed line 12 feeds valve chamber 11 as seen in Figure 4.

As to the objection to the perceived inconsistency between page 8, lines 24-27 and page 6, line 17, no such inconsistency exists. A closed actuator is defined on page 3, lines 2-4 of the application as filed as having an actor encapsulated by a metal bellows positioned in the space (between the actor body and the injector housing).

Accordingly, as seen in Figures 3 and 4, the actor 1 is encapsulated by metal bellows 14 to form a closed actor. In contrast, as seen in Figure 2 and as described in both of the above-noted passages, there is no bellows 14, such that the actor of Figure 2 is an open actor type. Seal 10 in Figure 2 seals the entire intermediate space, not just the space between the actor body and the fluid sealed metal bellows 14 as shown in Figures 3 and 4.

In view of the foregoing remarks and the changes made to the specification and drawings, the specification objections are believed overcome.

Replacement drawings are submitted for Figures 1-4. In Figure 1, the jacket surface of the actor body is designated by reference numeral 1a. In addition, reference numeral 12 is removed from Figure 1 to avoid confusion between reference numeral 12 in Figure 1 and reference numeral 12 in Figure 4.

Further, the rectangles between the actor body 1 and the spring 2 are shaded by using dots to indicate that the fluid 6 penetrates through the openings in the tubular spring 2 so as to directly contact the actor body 1 as disclosed on page 7, lines 17-19 and as recited in claim 1 as originally filed.

In Figure 2, the rectangular area defined between the actor body 1 and the spring 2 is amended to include shading denoted by the dots so that Figures 1 and 2 are consistent, showing the fluid penetrating the tubular spring 2 and contacting the actor body.

In Figure 3, reference numeral 1a is changed to reference numeral 14 as disclosed on page 9, lines 2-3 of the application as filed to indicate the metal bellows. Also in Figure 3, reference numeral 27 is added to denote the actor internal space as disclosed on page 9, lines 7-10 of the application as filed.

In Figure 4, reference numeral 17 is added, denoting the actor external space as disclosed on page 9, lines 13-17 of the application as filed.

As to the drawing objection to the "elastic membrane", Figures 1, 2 and 4 show a flexible membrane 5. The terms "flexible" and "elastic" are believed synonymous, such that there is believed support in the drawings and the specification for the claimed "elastic membrane".

Amending the drawings as above is believed to address each of the drawing objections noted in the Official Action without adding new matter.

Claims 1-12 were previously pending in the application. New claims 13-20 are added. Therefore, claims 1-20 are presented for consideration. Claims 4-7 and 10 are withdrawn from consideration as being directed to a non-elected species.

It is believed that claim 10 should be examined with the elected embodiment of Figures 1 and 2 and claims 1-3, 8, 9, 11 and 12. As noted in the Official Action, Figures 3 and 4 include reference numeral 15, indicating electrical connecting leads of the actor. However, applicants assert that Figures 1 and 2 also show electrical leads connected to the actor body. Even though such leads are unnumbered in Figures 1 and 2, these leads are in the elected figures and thus claim 10 is believed not inconsistent with Figures 1 and 2.

Claims 1-3, 8, 9, 11 and 12 are rejected under 35 USC 112, first paragraph, as failing to comply with the enablement requirement.

Reconsideration and withdrawal of the rejection are respectfully requested because claim 3 is amended to clarify that the actor body is "within" the tubular spring. As to the "elastic membrane", the flexible membrane 5 disclosed on page 7, lines 3-7 and as shown in Figure 1, for example, is believed to provide sufficient support for an elastic membrane.

Claims 1, 2, 8, 11 and 12 are rejected as unpatentable over REMBOLD et al. 6,079,636. This rejection is respectfully traversed.

Claim 1 includes an inert fluid which does not conduct electricity. Claim 1 also provides that an intermediate space is form-filled with the inert fluid except for an air reservoir. The air reservoir is at least as large as to allow the expansion of the heat coupling fluid which occurs at the highest operating temperature of the actor body.

The position set forth in the Official Action is that Figure 1 and column 4, line 5 of REMBOLD et al. teach an inert fluid. As to the reservoir, the position set forth in the Official Action is that it would be obvious to have a reservoir in order to allow for expansion of the heat coupling fluid. The position set forth in the Official Action is believed untenable for at least the following reasons.

First, the fluid disclosed by REMBOLD et al. is not an inert fluid that is electrically non-conductive. Column 4, lines 5 and 6 of REMBOLD et al. teach a coolant. Column 3, lines 24-26 of REMBOLD et al. disclose the coolant as a liquified or gaseous coolant flowing through ring space 16. Neither this passage nor any other passage of REMBOLD et al. discloses that the fluid is inert and electrically non-conductive.

Second, the motivation for having an air pocket is not consistent with the teachings of REMBOLD et al. REMBOLD et al.

does not contemplate allowing for the expansion of a heat coupling fluid. Rather, REMBOLD et al. teaches expansion in an axial direction of the actuator 2 based on the pressure increase at the spray-discharge nozzle 70. See for example column 4, lines 11-15, teaching that the fuel intake pressure is 3-4 bar, which is the pressure that must be overcome before the spray-discharge nozzle 70 opens.

Moreover, column 3, lines 24-28 of REMBOLD et al. that describe the coolant teach that the coolant flows in through a supply opening 17 and flows out through a cooling medium discharge opening (not shown). Such an open system having an inlet and outlet would not be susceptible to the expansion of heat coupling fluid. Therefore, REMBOLD et al. would not require an air reservoir to leave an air pocket in order to allow for the expansion of heat coupling fluid as suggested.

At least for the reasons set forth above, claim 1 is believed patentable over the cited prior art. Claims 2, 8, 11 and 12 depend from claim 1 and further define the invention and are also believed patentable over REMBOLD et al.

New claims 13-18 are directed to an inert non-electrically conductive fluid sealedly contained within an intermediate space between an injector housing and an actuator body. The analysis above regarding claim 1 is equally applicable to claim 13 as it applies to the inert, non-electrically conductive fluid. In addition, the limitation that the fluid is sealedly

contained within the intermediate space is not taught or suggested by REMBOLD et al. Support for the new claims can be found in Figure 2, for example.

New independent claim 19 is directed to an inert liquid which does not conduct electricity. Claim 19 also provides that the space between the piezoelectric actor body and the injector housing are sealable. Claim 19 is also believed patentable over REMBOLD et al. New claim 20 depends from claim 19 and provides that the coupling liquid is a liquid mixture, a fat, an oil, a paste, or a suspension. Support for new claims 19 and 20 can be found on page 8, lines 8-10 and lines 23-27 in conjunction with Figure 2.

In view of the present amendment and the foregoing Remarks, it is believed that the present application has been placed in condition for allowance. Reconsideration and allowance are respectfully requested.

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any

overpayment to Deposit Account No. 25-0120 for any additional
fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

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APPENDIX:

The Appendix includes the following item(s):

- ☐ - a terminal disclaimer
- ☐ - a 37 CFR 1.132 Declaration
- ☐ - a new or amended Abstract of the Disclosure
- ☒ - Replacement Sheets for Figures 1-4 of the drawings
- ☐ - a Substitute Specification and a marked-up copy of the originally-filed specification
- ☐ - a verified English translation of foreign priority document

AMENDMENTS TO THE DRAWINGS:

Replacement drawings are submitted for Figures 1-4.

In Figure 1, reference numeral 12 is removed. Reference numeral 1a is added, indicating the jacket surface. In addition, the "undotted" area designated by reference number 6 is "dotted" to clarify that the heat conducting fluid 6 extends through spring 2 to directly contact actor body 1.

In Figure 2, it is made clear that the element indicated by reference numeral 6 designates the heat conducting fluid which is in contact with the actor body 1.

In Figure 3, reference numeral 27 is added denoting the actor internal space. In addition, reference numeral 1A is changed to reference numeral 14.

In Figure 4, element 17 is added, indicating the external actor space.